

Mughal Architecture: Organization, Inspirations and Design

**Dr. Syed Ali Nadeem Rezavi
Aligarh**

**Presidential Address
Section II : Medieval India**



Indian History Congress
75th Session
Jawaharlal Nehru University
28-30 December 2014

First of all I should like to thank most sincerely the Executive Committee of the Indian History Congress, for having elected me President of the Medieval Section of this session. I feel obliged and humbled by the honour bestowed upon me.

Indian History, particularly Medieval Indian History stands at the crossroads today with attempts currently being made, to tailor it to concerns of modern-day politics, and, so to distort it and refashion it. Attempts are also being made to communalise the rich material heritage of the past, especially in the fields of art and architecture. Having worked on Mughal Architecture since more than a decade I have come to realise that (a) in spite of many path-breaking works, we still lack a full understanding of the field; and (b) there is, on the other hand, an onslaught to exclude a number of monuments of the past from official depictions of our heritage. There is, at the root of it, a common misperception that, on the basis of certain architectural features, some buildings are 'Hindu', while others are 'Muslim'. Thus we still keep on hearing terms like 'Hindu' and 'Muslim' architecture. The 'trabeate' – post and lintel technique – if applied, qualifies the building to be labelled as 'Hindu; the presence of an arch, however, qualifies it to be identified as 'Muslim'. Similarly, a geometric pattern in a design is 'Muslim', whereas, a chain-and-bell motif as a decorative feature, makes it 'Hindu'!

Unfortunately, little attention has also been paid to the actual people involved in building activity. It is generally assumed that the authorship of the building lies with the person who funded its construction, or in some rare cases, the person in whose charge the building was completed. Related with that is the question of influences and traditions from where the Mughal architects and builders drew their inspiration. Are there any features which can, in fact be labelled 'Mughal'? What were the designs and shapes of structures which were invoked or not invoked?

In this address, I have tried to address some of these issues. For a proper understanding, I have divided my discussion into three short sections, each dealing with organisation, inspiration and design respectively of the buildings.

The Organization of Building Construction:

The first question to be taken up is: who were the real 'builders' and how were they organized. Though buildings – mosques, tombs, residences etc – came to be constructed from the reign of Babur himself (1526-30), the Mughal school of architecture was really established only in the period of Akbar (1556-1605).

Quite often when our Persian chroniclers narrate the building of various forts, bridges, *havelis* or gardens, instead of providing the names of the architects or master-masons, and other precise details, they confine themselves to just praising their skill (as architects) – *mi'mārān-i jādu asar* and *najjārān-i āzarkār* or *muhandisān-i firdaus barīn*, high flown adjectives that hardly advance our knowledge.¹

¹ See for example Lahori, *Pādshāhnāma*, Bib. Ind. ed., Calcutta, 1866-72, Vol. I, pt.i, p. 221; Muhammad Salih Kambo, *Amal-i Salih* ed. G Yazdani, Calcutta. 1923, Vol. II, p. 294.

When Khwānd Amir discusses the division of society into three classes, he fails to mention the architects who must have formed an important group during his time. Even Abu'l Fazl who devoted a full section on the building establishment and provides the names of men of standing, intellectuals and artists, fails to name the architects of his time, which he in fact does in respect of physicians. The same appears to be the case with Badāūni and the author of the *Ṭabaqāt-i Akbarī*. In Medieval India the inscriptions which have so far been noticed mention architects, or calligraphers, but seldom the masons or brick-layers. Thus in the case of the Tāj Mahal, the only name which comes to us – and that too only from inscriptions – is that of Amānat Khān who has left his signature on one of the panels. The Persian sources are also silent as far as the personnel of the building construction are concerned.² They only mention the chief architects and engineers like Ustād Qāsim Khān, the architect of Agra Fort³ and Ustād Ahmad and Hāmid of the Red Fort of Delhi.⁴ As far as the palaces and structures at Fathpur-Sīkri are concerned, the sources are entirely silent about their actual builders. We are only informed that craftsmen from regions like Gujarat and Rajasthan were employed in the enterprise. From our sources it also appears that like other professions, the architects were largely hereditary in nature.⁵

While dealing with the expertise of stone-cutters in India, Babur tells us that in his buildings at Fathpur Sīkri, Bayāna, Dholpūr, Gwālīor and Kol (modern Aligarh), “as many as 1491 stone-cutters worked daily”.⁶ Abu'l Fazl tells us that three to four thousand masons and other craftsmen were employed in the construction of Agra Fort, while 'Arif Qandhārī says that two thousand stone-cutters and two thousand skilled masons were employed for the construction work, while eight thousand labourers assisted them.⁷ Though the Persian sources are silent as far as the work force employed in the Sikandara, the tomb of I'timād ud Daulah and the Tāj Mahal are concerned, William Finch gives the figure of three thousand for Sikandara.⁸ Irfan Habib, basing himself on the information available in the Persian sources, hazards a figure of 5,000 to 8,000 building craftsmen employed in the construction at Fathpur Sīkri.⁹

Our Persian sources refer to some designations of officers or professional men without naming them personally, e.g. the *mūr-i 'imārat* and *dārogha-i 'imārat* who appear to have headed the building establishment. Other categories of overseers and workers

² For the various categories of craftsmen involved in constructional activity and their wages, see my “Organization of Building Construction in Mughal India”, paper presented at the Indian History Congress, Dharwar, 1988; see also A.J. Qaisar, *Building Construction in Mughal India – The Evidence from Pā'inting*, Delhi, 1988.

³ Gulbadan, *Humayun Nama* Tashkent, 1959, p. 17 Abu'l Fazl, *Akbar Nama*, ed. Molvi Abdur Rahim, Calcutta, 1879, Vol. II, p. 247.

⁴ Waris, *Badshahnama*, MS. Raza Library, Rampur, (transcript in the Department of History Research Library, AMU, Aligarh), Vol. I, p. 38.

⁵ See for example the family of Lutfullah, *Dīwān-i Muhandis*, reproduced in Sayyid Sulaiman Nadwi, “The Family of the Engineers who built the Taj Mahal and the Delhi Forts”, *The Journal of Bihar Research Society*, Vol. XXXIV, Pts I & II, 1948, pp. 75-110 and M. Abdullah Chaghtai, “A Family of Great Mughal Architects”, *Islamic Culture*, Vol. XI, no. 2, April, 1937, 200-209.

⁶ Bābūmāma, ‘Abdur Rahīm’s Transl., Br. Lib. MS Or. 3714, ff. 412 B – 413 a; transl. A.S. Beveridge, London, 1921, vol. II, p. 520; See also Shaikh ZĀ'in Khawāfi, *Ṭabaqāt-i Bāburi*, tr. Hasan Askari, Delhi, 1982, p. 134.

⁷ Abu'l Fazl, *Akbarnāma*, ed. Abdur Rahim, Calcutta, 1886, Vol. II, p. 247; Ārif Qandhārī, *Tārīkh-i Akbarī*, Rampur, 1962, p. 145.

⁸ Finch’s account in *Early Travels in India*, 1583-1619, ed. Foster, Oxford, p. 121.

⁹ Irfan Habib, “The Economic and Social Setting”, *Marg*, vol. XXXVIII, no. 2 (special on Akbar and Fatehpur-Sīkri), pp. 79-80.

mentioned in our sources are the *mi'mār* (architect/mason), *muḥandiṣ* (architect), *naqshānavīs* (plan drawer), *naqqāsh* (carver), *sangtarāsh* (stone-cutter), *gul tarāsh* (floral designer), *parchīnkār* (inlayer/engraver) and the *najjār* (carpenter), apart from the generality of artisans and labourers.

The *mīr-i 'imārat* was an official who supervised the construction of a building or an edifice. It was he who apart from supervising the construction was also responsible for the recruitment of the various masons, artisans and labourers. While dealing with details of various bureaucratic offices and positions under the Mughals, the author of the *Hidāyat-ul Qāwā'id* (c. 1700) gives the qualifications that were deemed necessary for an efficient *mīr-i 'imārat*. He was required to be aware of the art of construction and also possessed a sound knowledge of arithmetic (*ḥisāb*).¹⁰ If he himself was not well versed in *ḥisāb*, he was to hire a person who was a master in it. The *mīr-i 'imārat* was also required to have some technical knowledge as well. Thus he was supposed to know the number of bricks that were needed to construct a house of a certain size, the method of preparing the mortar and the relative quantities of its ingredients.¹¹ Apart from this, he was required to be aware of the prevailing wages of the masons, artisans and labourers. Hidayatullah cautions that the *mīr-i 'imārat* should also be aware of the prices of the lime, bricks, wood and other building material so that the person for whom the edifice is being built remains satisfied. His dealings with the subordinates were also supposed to be such that the work could be carried out in a congenial atmosphere and at a rapid pace.¹² We are further told that if the chief architect (*sardār-i mi'mārān*) were to be rewarded with a robe of honour or some other gift from the court, the *mīr-i 'imārat* should himself make gifts to the other workers in a similar manner from his own account so that they may not be disheartened.¹³

Once the building was fully constructed it was put under the supervision of the *dārogha-i 'imārat*, the Incharge of the buildings, who was responsible for its upkeep and repairs as the need arose.¹⁴ To help him discharge his duties, a number of *aḥadīs* (royal troopers),¹⁵ *bandūqchīs* (musketeers)¹⁶ and a host of 'shovel-wielders' (*beldārs*)¹⁷ were placed under his charge.

¹⁰ Hidāyatullah Bihārī, *Hidāyat ul Qawā'id*, Ms., University Collection, Azad Library, AMU, f. 40(a).

¹¹ *Ibid*, f 40(b)

¹² *Ibid*.

¹³ *Ibid*. For his responsibilities also see Gopāl Rāi Surdaj, *Durrul 'Ulūm*, f. 60(a) (Rotograph in the Research Library of the Department of History, Aligarh).

¹⁴ Similar supervisory distinction can be seen in the canal construction work. The actual digging of the canal, building of dykes, the control and disbursement of wages to masons and artisans was the job of *mīr-i āb*. See for example, Akbar's *sanad* of 978 (1570-71) in Lieut., Yule, 'A canal Act of the Emperor Akbar with some notes and remarks on the History of Western Jumna Canal', *JASB*, 1846, vol.XV, Calcutta, pp.213-23; also Memorandum on Chitung River (1635) contained in *Letters of Shaikh Jalāl Hisāri and Bālkrishan Brahman*, MS (Rotograph Dep'tt. of History). Badāūnī informs us that Nūruddīn Muhammad Tarkhān, who was an expert in the science of *ḥindsa*, *riyāzī* and *nujūm* (arithmetic, geometry and astronomy) was appointed as *mīr-i āb* to dig Shah Nahr by Akbar (Badauni, *Muntakhab-u Tawārīkh*, ed. Molvi Ahmad Ali, Calcutta, 1869, Vol. IV, p. 197). After a canal was completed, it was placed under the charge of *dārogha-i nahr* who with the help of his *gumāshṭas* and *mutasaddis* looked after its upkeep and collected the canal cess (*nahrāna*). He was also entitled to recruit labourers for the repair work. See, for example, B.N Goswami and J.S. Grewal, *The Mughal & Sikh Rulers and the Vaishnavas of Pindori*, IAS, Simla, 1969, Document No. III, pp. 94-95; also J.S. Grewal, 'Some Persian Documents from Nurpur', *Historians Punjab: Miscellaneous Articles*, Amritsar, 1974, pp. 79-80.

¹⁵ Mughal Documents, *Catalogue Of Aurangzeb's Reign*, ed. M.A. Naeem, Vol.1, Pt.I, document Nos. 1/204 arid 1/1468.

Before the actual construction could start, it appears that certain experts were asked to submit a plan. Our sources, however, have very few references as to how these plans were made. It is only in the nineteenth century, when books of tourist interest for the Tāj were prepared that we find a detailed mention of *naqsha navīs*.¹⁸ Interestingly enough in these works, the *naqsha navīs* is mentioned as the chief architect. The mere absence of a mention of *naqsha navīs* does not necessarily mean the non-existence of this profession. The sheer magnitude of the Imperial buildings and their symmetrical appearance hints towards the existence of expert plan-drawers. We find Babar lamenting at the asymmetrical and un-planned buildings which he found on coming to India.¹⁹ One of the surviving *Akbarnāma* paintings preserved at Victoria and Albert Museum shows Bābur overseeing the laying out of the *Bāgh-i Wafa* Garden. The painting contains a depiction of a man supervising the work with the help of a plan on a rectangular sheet of graph-paper. The men to whom instructions are being given are shown holding a long rope with which they are measuring the garden-beds. In all probability the same method was used in carrying out construction of buildings according to plan set out on a graph. For only then can one appreciate the Emperor's indignation at the un-planned buildings of India.²⁰ An interesting passage in Manucci's account very lucidly brings out the detailed manner in which the plans of houses were drawn by architects before the actual construction. Discussing the whimsical nature of a Mughal noble, Ja'far *Khān*, he writes:

"...But it was a stranger thing he [Ja'far *Khān*] did when the architect brought him the plans of a fine palace that he intended to build. For after asking as to *various sections of the plan, he ended by inquiring about a certain place, where were depicted the privy retreats*. The architect said it was the necessary place, whereupon he held his nostrils with his right hand, and puckering up his face, made a sign with his left to take the plan away, as if it smelt merely through having this painting on it."²¹

Our sources generally use the term *tarah* for the plan drawing as for any pattern. Abul Qāsim Namakīn in his *Munsh'āt* includes *tarahī* or plan-drawing, as one of the essential functions of the *mi'mār*.²² Further, we are informed that the fort of Shāhjahānabad was constructed according to the *tarah* ratified by the emperor himself.²³ Sālih Kanboh says that even the covered *bāzār* (*bāzār-i musaqqaf*) at the fort was constructed after Shāhjahān, having seen a *tarah* of a similar market at Baghdād, ordered that it be sent to Mukarramat *Khān*, the supervisor of the Red Fort.²⁴ Asaf *Khān*, we are informed was an expert in *tarahī* and it was he who placed a number of plans for the proposed *khwābgāh* (bed-chamber) at

¹⁸ *Ibid.*, Document No. 1/96.

¹⁹ *Ibid.*, Document nos. 1/131, 1/151, 1/735.

²⁰ For example, *Dīwān-i Afriḍī*, *Tarikh-i Taj Mahal*, *Ahwal-i Taj Mahal* etc. For their references and date of compilation see R. Nath, *The Taj Mahal and its Incarnation*, Jaipur, 1985; S.M. Latif, *Agra: Historical and Descriptive*, Calcutta, 1896 (new ed. pub. 1981), pp. 116-7; S.C. Mukherji, "Architecture of the Taj and its Architect", *Indian Historical Quarterly*, Vol., I, 1933, Calcutta, pp. 872-9, etc.

²¹ Shaikh Zā'in Khawafī, *Tabaqat-i Baburi*, tr. Hasan Askari, Delhi, 1982, p.108.

²² A plan of the houses of Santidas Sahu which were gifted by him survives in a *hibanama*, see M.A. Chaghtai's article in *JASP*, *op.cit.*

²³ Manucci, II, p.146.

²⁴ Abul Qasim Namakin, *Munshat-i Namakin*, Aligarh Collection, Maulana Azad Library, AMU, no. *farsiya* 26, f. 133 (b)

²⁵ Wāris, *Pādshāhnāma*, Ms. (transcript Research Library, Department of History, AMU, Aligarh), p.39; see also Shāhnawāz *Khān*, *Ma'āsir ul Umara*, ed. Abdur Rahim & Ashraf Ali, Bib.Ind., Calcutta, 1881-91, III, p.463.

²⁶ *Amal-i Sālih*, *op.cit.*, II, pp.471-72.

Lahore Fort made by certain 'expert architects' (*ustādān*) before Shāhjahān, who then, chose one plan which was ultimately executed by the engineers (*muhandisān*).²⁵ The making of the *tarah* is also mentioned in some of the surviving Mughal documents. For example, the *Nigārnāma-i Munshī*, a collection of administrative documents, contains a reference to the preparation of a *tarah* of a damaged building at Peshāwar.²⁶ Similarly another document of Aurangzeb's reign refers to Jawāharmāl, a *mi'mār*, who prepared a *tarah* of a *haveli* of a deceased noble.²⁷

Sometimes the term *naqsha* was also used to refer to a plan: Salih Kanboh uses both terms, the *tarah* and the *naqsha*.²⁸ Shahnawaz Khān in his *Ma'āsirul Umara* informs us that the Mughal court possessed the *naqshās* of both Baghdad and Isfahan.²⁹

The official histories have also recorded the details of many major monuments of their period. These details include even minor intricacies like the thickness of the plinth, the height of the various portions, their length and breadth, the curvature of the dome etc. For a person like Lāhori it would not have been possible to discuss the details of a building of such dimensions as the Tāj, unless he was provided these details by a plan or map placed before him.³⁰ The manner in which he describes the bulbous dome of the mausoleum also indicates the use of a plan or drawing.

We also find that the builders under the Mughals had certain rules based on which the plan might have been drawn. Thus the author of *Bayāz-i Khwushbū* writing in the reign of Shāhjahān gives examples of details of certain mansions and gardens in order to stress how the houses, baths and gardens should be ideally constructed.³¹ Dealing with arched-gates of buildings, the author says:

"The breadth of the gate of the building should be 1 *dira*, the height 2 *dira* and its *chaukhaṭ* should be one foot high. If the dimensions are less than this, it (the gate) would look ugly."³²

The actual construction work was carried out under the *mi'mār*. The term normally denoted a mason, but was also used for the chief of works or supervisor. The chief architect under whose supervision the other architects constructed the Agra Fort under Akbar is called a *mi'mār* by Gulbadan in her Memoirs.³³ Similarly the Fort of Delhi was completed under

²⁵ Lāhori, II, *op.cit.*, p.224; *Amal-i Sālih*, *op.cit.*, II, p. 8

²⁶ Munshi Malikzāda, *Nigārnāma-i Munshī*, Ms. No. 36, Research Library, Department of History, AMU, Aligarh, ff. 157 (a)-(b).

²⁷ *Akhbār* dated 43rd RY of Aurangzeb, *Akhbār- darbār mu'alla*, Royal Asiatic Society, London (microfilm Research Library, Department of History, AMU, Aligarh, no. 30)

²⁸ *Amal-i Salih*, *op.cit.*, III, p.28.

²⁹ *Ma'āsir ul Umara*, *op.cit.*, II, p.469; For the *naqsha* of a Deccan Fort sought to be captured by Aurangzeb, see, *Kalimāt-i Taiyabāt*, ed. Ināyatullah Khān, Ms., Aligarh Collection, Maulana Azad Library, AMU, Aligarh, *farsiya*.39, no. 278.

³⁰ Lāhori, *op.cit.*, Vol. II, pp. 323-31.

³¹ *Bayāz-i Khwushbū*, Ms. IOL Ethe 2784 (I.O.828); Rotograph copy in the Research Library, Department of History, AMU, ff. 108(a) - 111 (a).

³² *Bayaz-i Khushbui*, f. 108 (b). Suggestions are made for construction of tombs, minarets and garden-beds. For similar directions as to dimensions for buildings being built at Jaipur in 1720's under the supervision of Vidhyadhar., the architect of Raja Jai Singh, see A.K. Roy, *History of the Jaipur City*, New Delhi, 1978, pp.41-42, 52.

³³ Gulbadari, *Humayun Nama* Tashkent, 1959, p.17; See also Abul Fazl, ed. Molvi Abdul Rahim, Calcutta, 1879, Vol. II, p. 247.

the directions of Ustad Ahmad and Ustad Hamid, both being 'expert *mi'mārs*'.³⁴ We are also told that the Taj Mahal was constructed by the architect of the Delhi Fort Ustād Ahmad *mi'mār* and his son claimed that he himself and his brothers were all expert *mi'mārs*.³⁵ Abdur Rahim Khān-i Khānān too had in his service a '*mi'mār*' who had no parallel.³⁶ These master-masons had under their control a number of ordinary *mi'mārs* (masons) whose job appears to have been mainly brick-laying. They in fact, were the real masons. Their expertise extended to estimating prices of buildings and lands: witness the task assigned officially to Lachhmi *mi'mār* at Mathura to estimate the price of a private house early in Aurangzeb's reign.³⁷ The *mi'mārs* of supervisory levels enjoyed both importance and affluence can be deduced from their portrayal in Mughal miniatures, where, while directing building work, they are depicted fully clad from head to foot.³⁸

Another category of experts who worked hand in hand with the *mi'mār* were the *muhandis* or the mathematicians. They appear to be expert in the art of arithmetic and geometry, which they applied to calculate the proportions of the foundations and heights.³⁹ The term *muhandis* was also generally applied to the architects. Lutfullah, the architect had the title 'Muhandis'. He was well-versed in the science of mathematics, which he says, he applied while constructing buildings.⁴⁰ In fact he has left behind works on mathematics.⁴¹ 'Atāullah Rashīdī, the brother of Lutfullah Muhandis, was a master of arithmetic and architecture.⁴² In fact, throughout his *Dīwān*, Lutfullah uses the term *muhandis* for architect.⁴³ We are also told that Ustād Ahmad, the architect of Delhi Fort had no parallel as far as his knowledge of mathematics is concerned.⁴⁴

Next in importance to the *mi'mār* was the *sangtarāsh* (stone-cutter) or the *najjār* (carpenter). While dealing with the positive aspects of Indian society, Shaikh Zain while summarising the *Bāburnāma* says:

"They are far more numerous and exceed in number than those of any other country... in the royal edifices at Agra 680 stone-cutters who are the natives of the city, have been at work every day in special departments of the governments, and in laying in the foundations of the buildings of Fathpur Sīkri, Biāna, Dholpūr, Gwālīor, Kol, and, in carrying out the imperial command, as many as 1491 stone-cutters worked daily.

³⁴ Waris, Badshah Nama, Ms. Raza Library. Rampur (transcript copy in Research Library, Deptt. of History, AMU), vol., I, p. 38.

³⁵ Lutfullah Muhandis, *Dīwān-i Muhandis*, reproduced in Sayyid Sulaiman Nadwi, "The Family of the Engineers who built the Taj Mahal and the Delhi Forts", *The Journal of Bihar Research Society*, Vol. XXXIV, Pts I & II, 1948, pp. 75-110 and M. Abdullah Chaghtai, "A Family of Great Mughal Architects", *Islamic Culture*, Vol. XI, no. 2, April, 1937, 200-209.

³⁶ Mulla Abdul Baqi Nahawandi, *Ma'asir-i Rahimi*, ed. M. Hidayat Husā'in, Calcutta, Vol. II, pp.610-11.

³⁷ *Mathura Documents*, dated 10 Jamadi I, 5th R.Y of Aurangzeb (Xeroxed)

³⁸ See for example *Akbarnāma* pā'ntings depicting the construction of Fathpur Sikri and Agra Fort preserved in Victoria and Albert Museum.

³⁹ See for example Lahori, Vol. I., Pt.i, p, 223.

⁴⁰ *Dīwān-i Muhandis*, op.cit.

⁴¹ Some of his books which survive include (i) *Risala-i Khawās-i a'dad*, MS. BM 16744 / 3; (b) *Sharh-i Khulāstul Hisāb*, MS. Azad Library, AMU, Aligarh (2 copies).

⁴² *Dīwān-i Muhandis*, op.cit.

⁴³ *Ibid.* In modern Persian also the term *muhandis* stands for an architect.

⁴⁴ Ahmad Ali Sandelvi, *Makhazan-ul Gharāib*, MS. Shibli Academy, p. 153.

Moreover, every one of the pillars of the government (grantees) who erect buildings of stones, employ a. large number of the stone-cutters in the same way.”⁴⁵

Bābur himself alludes to the large number of *sangtarāsh* in India giving the numbers that Shaikh Zain has reproduced. He also writes that these stone cutters were also sent to other countries.⁴⁶ Abu’l Fazl in his chapter on *a’in-i imārat* mentions two categories of *sangtarāsh* viz. the *naqqāsh* who was the tracer or carver and the *sādahkār* or the plain stone-cutter.⁴⁷ The *naqqāsh* enjoyed a superior position relative to the *sādahkār*: the *Akbarnāma* paintings show the carvers better dressed than the *sādahkār*.⁴⁸ The stone was first handed over to the *sādahkār* who would cut the stone into the required shape. It was then handed over to the *naqqāsh* who would trace the required floral or geometrical design before handing it over to the *parchīnkār* (engraver) or *mambatkār* (embosser) as per the need. For carving out the more intricate designs, the stone marble was handed over to the *gultarāsh*.⁴⁹

After the various categories of the stone- cutters and carvers accomplished their work, these stone pieces were ready to be fixed in the building. We may assume that due to a large number of stones adorned with various floral and geometrical designs, they were also numbered to enable them to be placed in proper order.⁵⁰ Quite often the stone cutters themselves had the job of joining the stone-pieces together. Shaikh Zain informs us at the stone cutters so closely and expertly joined the stones in the buildings that ‘even the sagacity of the acute and subtle critics fell in state of amazement.’ He further states that the stone cutters accomplished this task of joining without use of any plastering material or iron.⁵¹ The title of *ustād* (master) was also bestowed on such expert *sang tarāsh*. Thus Babur mentions one Ustād Shāh Muḥammad who was entrusted with the construction of a building at Dholpūr.⁵²

A close study of Mughal monuments suggests a very interesting practice. The stones adorning the plinths, stairs, pavements etc. of the various monuments at Delhi, Agra and Fathpur Sīkri have certain marks carved on them. R.Nath designates them as the masons’ marks.⁵³ But they are surely stone-cutters’ marks. Whether each mark denoted a family of stone cutters or their respective guilds, we do not know.

Yet another craftsman who was important was the *khwushnawīs* or the calligrapher who was responsible for designing and executing inscriptions to be fixed on the building. Whether like a modern calligrapher he would execute his art on paper later to be transferred on stone by the *naqqāsh* and *parchīnkār*, we do not know. But from what we know, it seems, he was held in good esteem. It is only his name that time and again we find inscribed

⁴⁵ *Tabaqāt-i Bāburi*, op.cit., p. 134.

⁴⁶ *Baburnāmah*, ed. A.S. Beveridge, London, 1971, f. 291(b)

⁴⁷ Abul Fazl, *A’in-i Akbari*, Nawal Kishore, Vol.I, n.d. p. 117.

⁴⁸ *Akbarnāma Pā’ntings*, op.cit.

⁴⁹ For their separate skills see Lāhori, II, p.324; *Ahwāl-i Tāj Mahal*, Mirza Beg, (MS. Research Library, Deptt. of History, AMU); R. Nath, *The Taj and its Incarnation*, op.cit., pp. 40-41.

⁵⁰ Even today one can see the practice of numbering the stones at the Dayāl Bāgh Mandir at Agra which is under construction. As per the design, the stones are numbered before being handed over to the mason who has the job fixing them on the brick walls of the temple.

⁵¹ *Tabaqāt-i Bāburi*, op.cit., p. 157.

⁵² *Babur Nama*, op.cit., f. 339(b).

⁵³ R. Nath, *The Taj Mahal and Incarnation*, op.cit., p. 44; For the marks of professionals, including the stone cutters see *Infra*.

along with his work on the building. Thus one of the slabs on the main portal of the Taj gives the name of Amānat Khān, the *khwush-navīs*.⁵⁴

Yet another class of master-craftsmen and artisans was that of *najjār* or *durūdgar* (carpenter).⁵⁵ Carpenters had the responsibility of constructing the doors and the windows. Some of the European accounts mention wooden houses,⁵⁶ and Abu'l Fazl mentions wooden structures.⁵⁷ In his chapter on buildings, Abu'l Fazl mentions the carpenters just after the stone-cutters. According to him, the carpenters were divided into two groups. The first group of *durūdgar* appear to be those who shaped and chiselled the wood. These he subdivides into five categories. The second group, which he calls *sādahkār* or plain job-workers, who probably just shaped the planks etc, are divided into three categories. The man responsible for sawing the logs of wood was called *ārah-kash* ('saw-driver').⁵⁸ The need for carpenters in making windows would also have been considerably high due to the high cost of glass for the panes.⁵⁹ Abu'l Fazl thus speaks of *pinjarasāz* who were the lattice and wicker workers who probably decorated the windows etc.⁶⁰ Whenever glass was used the services of *tābdān tarāsh* were required.⁶¹

The building under construction cannot be completed without the presence of artisans who have the expertise in digging and brick-laying. Thus our Persian sources have innumerable references to *beldārs* or 'shovel wielders'.⁶² A lofty building being constructed with the use of stone and bricks needed the service of the *beldārs* to dig its strong foundations. Then again, the mason busy in his work was in need of help of certain artisans to prepare the bricks and bring them to him. Thus, Abu'l Fazl divides the *beldārs* into two categories. The first were those who helped in the construction, of walls and the second were ordinary diggers.⁶³ When the bricks were being cemented with the help of lime mortar, the services of a *gilkār* were required, a kind of lime-mixer or mortar-maker.⁶⁴ Another cementing material which was in vogue at that time was prepared with the help of *surkhī* or pounded bricks. This work of pounding the brick and mixing it with lime mortar was performed by *surkhīkob* or the brick-pounder.⁶⁵ The tiles which were used in roofing the houses of the middle-income group were prepared by the *khisht-tarāsh*.⁶⁶ From the Mughal paintings it appears that most of these workers were ill-clad and went about - as in the

⁵⁴ See also Latif, *Agra: Historical And Descriptive*, *op.cit.*, description of the Taj; . R.Nath, *op.cit.* pp. 41-2. Abdul Bāqī also mentions quite a few *khushnawīs* and *naqqāsh* (calligraphist) see for example *Ma'āsir-i Rahīmī*, ed. Hidayat Hossein, 1925, Vol. III, p.1682.

⁵⁵ Abul Fazl used the term *durūdgar* for them. *A'in*, I, p. 117.

⁵⁶ Pelsaert, *op.cit.*, p. 34; Bernier, *op.cit.*, p.398.

⁵⁷ *A'in*, Vol. I, *op.cit.*, p. 562; For the use of wood in houses and its importance see *Hidāyat-ul Qawā'id*, *op.cit.*, f. 40(b). For the expert carpenters of Calicut, see Pyrard, *The Voyage of Francois Pyrard of Laval*, tr. ed. Alfert Gray, Vol. I, n.d., London, p. 403.

⁵⁸ *A'in*, Vol.I, *op.cit.*, pp. 117

⁵⁹ Fryer, *op.cit.*, p. 92.

⁶⁰ *A'in*, *op.cit.*, Vol. I, p. 117.

⁶¹ *A'in*, *op.cit.*, Vol. I, p.118

⁶² See for example *Bāburnāma*, *op.cit.*, f. 291(b); *Tabaqāt-i Bāburi*, *op.cit.*, p.115; Lahori, I, *op.cit.*, p.323 Ali Muhammad Khan, *Mirāt-i Ahmadi* ed. Nawab Ali, Baroda, 1928, Vol.1, p. 276; M.A. Naeem, *Mughal Document, Catalogue of Aurangzeb's Reign*, vol. I (1658-63), Hyderabad, 1980

⁶³ *A'in*, *op.cit.*, Vol. I, p. 117.

⁶⁴ *Ibid*. Interestingly he is placed the first in the list of artisans employed in the Building establishment.

⁶⁵ *Ibid*

⁶⁶ *A'in*, *op.cit.*, Vol. I, p. 118. For the use of tiles in mercantile houses at Ahmadabad see Jawaid Akhtar, 'Merchants and Urban Property: A Study of Cambay Documents of the 17th-18th centuries: Professor R.N. Mehta Felicitation Volume, Jaipur, 1999

present age - in a semi-clad condition with only a loin-cloth and cloth-piece used to help in carrying load; the women carrying bricks are, on the other hand shown with blouses and short sarees.

Abu'l Faḡl also mentions a number of artisans who were required in the construction of thatched-houses and huts which were used as dwellings by the common people in the towns and countryside.⁶⁷ They included the *chhappar-band* (thatchers), *bāns-tarāsh* (bamboo-cutters) *pātāl-band* (reed-binders) and *lakhīra* (varnishers of reeds).⁶⁸

The water needed for the construction work was supplied from the wells (*chāh*) which were dug by *chāh-kan* (well diggers) and frequently cleaned by yet another set of experts called *ghoṭa-khor*.⁶⁹ A worker was also needed to carry this water to the place where the mortar was being prepared. He was known as the *ābkash* (water-carrier).⁷⁰

The practice of constructing water tanks and fountains near palaces and tombs was quite common. The water to these fountains was supplied through underground water channels and pipes. Our sources are silent as to their builders. In Persia, Afghanistan and other Central Asia, the experts who constructed these underground water pipes were known as *mukhānis*, *chāhkhu*, *qumūsh* or *qārizkan*.⁷¹ Whether under the Mughals they were known by any of these names, we do not know.

Thus we see that the building establishment under the Mughals generally consisted of numerous categories of craftsmen each expert in his field, working under the command of a supervisor.

As far as the construction of Imperial buildings was concerned, there appears to have been some sort of a 'contract' system. Gopāl Rāi Surdaj includes in his work an *istighāsa* regarding the construction of two *sarais* between Narwar and Sironj, which mentions an amount set aside for the construction. It was from this amount that the salaries were to be paid and material bought by the building supervisor.⁷²

Once the supervisor for the construction was chosen and an architect appointed the next step was to draw the plan. The actual work would start with the *bēldār s* digging the foundations. The masons would then raise the plinth over this foundation and then construct the walls. Mughal paintings abound in depictions of spades, hammers and other instruments which were used for these purposes. Some workers would busy themselves in preparing and mixing the mortar. Others would carry the bricks and the mortar to the masons. For the mortar, barrows carried by two workers, one on each side were utilized. For bricks, baskets were used. Wheel-barrows, not depicted, were presumably not in use. It also appears that the bricks needed for the building were and baked in kilns quite near the site of the building

⁶⁷ For thatched huts of common people, see for example, Fr. J. Xavier's Letter, *JASB*, n.s. no. XXIII, 1927, p. 125; Finch, *Early Travels*, p. 185; Tavernier, I, *op.cit.*, pp.122,128. See also Badauni, *op.cit.*, p.398 etc.

⁶⁸ *A'in*, *op.cit.*, Vol. I., pp. 117-8.

⁶⁹ *Ibid*

⁷⁰ *Ibid*

⁷¹ See Iskandar Beg, *Ālam Ārā-i 'Abbāsi*, Isfahan, 1956, Vol.I. p. 473 also The Encyclopaedia of Islam, (new edition), Vol. IV, Leiden, 1978, s.v. *kanat*.

⁷² *Durrul 'Ulūm*, *op.cit.*, ff. 60(a)-(b); See also *Tuzuk-i Jahāngīrī* ed. S.Ahmad Khan, Ghazipur, 1863, Vol. II, p. 347 where there is a mention of Jahangir giving Rs. 30, 000 to Haidar Malik to construct a canal. The amount was to be utilized for material and labour.

under the eyes of the Supervisor.⁷³ The paintings also depict the work of each category of worker being supervised by a person with a guiding stick in his hand. The use of ramp made of wood was also known along with the ladder, with the help of which the labourers could climb up to the level where the bricks were to be laid.

The embossers and carvers used iron chisels and hammers. Probably the *ābkash* used leather bucket (*mashk*) like the *saqqas* (water-carriers).

The practice of repairs of the old buildings is also referred to, despite Pelsaert's statement that this was entirely neglected.⁷⁴ Thus we find Jahāngīr ordering 'Abdul Karīm Mā'mūrī, an architect, to repair 'the buildings of the old kings' at Māndu.⁷⁵ An iron plate inscription on the gate of the mausoleum of Sultān Hoshang Ghorī (d. 838 A.H. / 1434-5 A.D.) at Māndu mentions a host of architects who went there for inspection.⁷⁶ In a very interesting letter to Shāhjahān, Prince Aurangzeb mentions the repair works being carried out at the Tāj Mahal whose ceiling had started leaking during the rains. He urged that there was greater need to pay attention to the repairs in order to safe-guard the ground structure.⁷⁷ Dealing with the repair-works going on at the Tāj, he writes:

"The architects (*mi'mār*) are of the opinion that if the roof of the second floor is opened up and treated afresh with lime mortar over which half a *gaz* (yard) layer of mortar grout is laid (*tehkāri*) then probably the semi-domed portals, galleries and the small domes may be made water tight."⁷⁸

Aurangzeb then goes on to remark that the architects 'confess their inability to fully repair the bigger Dome'.

As to the wages and salaries of the persons involved in official construction work is concerned an important set of data is furnished by the *Ā'in-i Akbarī*. For Shāhjahān's reign an idea can be formed from some of the *qabẓ-ul wuṣūl* documents preserved at the Hyderabad Archives.⁷⁹ Information in this regard also comes from Rajasthan for the time of Aurangzeb and after.⁸⁰

As far as the *mīr-i 'imārat* is concerned our sources do not contain any information regarding his remuneration. It is only in the nineteenth century works on the construction of Tāj Mahal that mention is made of a salary of Rs.1000/- per month,⁸¹ but such information can be given little credit.

⁷³ *Ibid.*, f. 60(b).

⁷⁴ Francisco Pelsaert, *Jahangir's India The Remonstratie*, transl., W.H. Moreland & P. Geyl, Delhi, 2009, p. 56

⁷⁵ Lahori, Vol. I, *op.cit.*, pp. 137, 182.

⁷⁶ *Epigraphia Indo-Moslemica*, 1909-10, p. 23 cf. M.A. Chaghtai, 'A Family of Great Mughal Architects' *Islamic Culture*, *op.cit.*, p. 200.

⁷⁷ Abul Fath Qabil Khan, *Ādāb-i Ālamgīrī*, ed. Abdul Ghafur Chaudhuri, Lahore (Pakistan), 1971, Vol. I, pp. 111-13.

⁷⁸ *Ibid.* Vol. I, p. 112.

⁷⁹ See *Mughal Documents: Catalogue of Aurangzeb's Reign*, ed. M.A. Nacem, Vol. I, (1658-63), Hyderabad, 1980.

⁸⁰ *Kamthāna Bahis* of Bikaner, see Anjali Chatterjee, "Wage Structure of Artisans and labourers engaged in constructional work in Medieval Rajasthan (A.D. 1670- 1761) — a case study of Bikaner State," *PIHC* 1985, pp. 316—25; *Arhsatta Imāratī* (c.1694) MF, Research Library, Deptt. of History, AMU.

⁸¹ For example see Mirza Beg, *Ahwāl-i Tāj Mahal*, , *op.cit.*, f.47

The *dārogha-i 'imārat* in the first regnal year of Aurangzeb had a salary ranging from Rs.230/- per month to Rs.55 and 12 *ānnas* per month. It appears that his wages depended upon the size and nature of the building which was given under his charge.⁸² Sometimes the *dārogha-i 'imārat* was also given a *mansab*. In fact for the Imperial buildings a *mansabdār* was often appointed as its *darogha*.⁸³

The salary of the Chief Architect similarly is not mentioned. Qāsim Khān, an architect under Akbar held a *mansab* of 3000⁸⁴ while a latter day architect, Lutfullah Muhandis held a rank of 400.⁸⁵

The mason (*mi'mār*) was one of the most highly paid artisans under Shāhjahān. From some of the *qabẓ-ul wuṣūl* documents relating to the early years of Aurangzeb's reign it appears that the salary of the *mi'mār* varied between 26.6 *dāms* to 12 *dāms* per day, the *dām* being a copper coin.⁸⁶ *Kamthāna bahīs* from Bikaner give the per day wage as 5.8 *dām* for the local artisan and 25 *dām* per day if they were brought from the Deccan.⁸⁷ In 1694 we find that he was earning 8.88 *dām* per day at Amber.⁸⁸ A mason recruited to repair some structures at Shāhjahānabad in 1711 was paid the equivalent of 9.12 *dāms* per day.⁸⁹

According to Abu'l Faẓl, the daily wages of *gilkār* varied from 7 *dām* to 4 *dām* (when 40 *dām* went to the rupee).⁹⁰ In Bīkāner he was paid 7.5 *dām* to 5 *dām* per day in the latter half of the 16th century.⁹¹ By 1694 his wages equalled those of the *mi'mār*, i.e., 8.88 *dām* per day, at Amber.⁹²

As far as the stone-cutters and carvers are concerned, we find that a stone cutter doing plain work earned 5 *dāms* per square *gaz* of stone during Akbar's reign.⁹³ During Aurangzeb's reign the amount paid to them was 8.88 *dāms* for a full day's work.⁹⁴ This might not necessarily imply a decline in wages, for much depended on the quantity and quality of work. The carvers were paid 6 *dāms* per square *gaz* for their labour under Akbar. Our sources are silent with regard to the wages of *parchīnkār*, and other skilled work. The only information which we have comes from the unreliable *Ahwāl-i Tāj Maḥal* where they are said to have received Rs.380 to Rs.200 a month their work at Tāj.⁹⁵

The importance of the carpenters and their respective divisions can be seen from the wages ascribed to them in the *Ā'in*. Abu'l Faẓl mentions their wages as between 7 *dāms* and

⁸² *Mughal Documents, op.cit.*, Doc. Nos. I/340, I/1002.

⁸³ For example see Lahori, I, i, p.474; ii, 2; Vol. II, p. 103, Waris, *op.cit.*, II, 173.

⁸⁴ *Akbarnāma, op.cit.*, Vol.III, p. 87, 702; *Ā'in, op.cit.*, Vol. I, p. 224

⁸⁵ Lutfullah, *Ruqqāt*, MS, Maulana Azad Library, Aligarh Muslim University, f. 24.

⁸⁶ *Mughal Documents, op.cit.*, Doc. no's. III/347, III/358, III/595, III/890, III/976, IV/300, IV/560, IV/794, IV/1091, IV/1195, V/839, V/959, V/1713, V/1922 and V/2051. I have converted the wages quoted in rupees into *dāms*.

⁸⁷ *Kamthāna Bahīs, cf.* Anjali Chatterjee, *op.cit.* I have converted the wages into *dāms* for the sake of comparison by making use of S.P. Gupta's rates of *takas* to the rupee (*The Agrarian System of Eastern Rajasthan*, Delhi 1986), and taking one *dam* = 1/40 Rupee as at the time of the *Ā'in*.

⁸⁸ *Arhsaṭṭa Imārati, op.cit.*, A.D. 1694. I am thankful to Dr. Sumbul Haleem Khan for providing the references contained in this particular source which is in Rajasthani.

⁸⁹ *Ibid*

⁹⁰ *Ā'in, op.cit.*, Vol. I, p. 117.

⁹¹ *Kamthāna Bahīs, op.cit.*

⁹² *Arhsaṭṭa Imārati, op.cit.*, A.D. 1694.

⁹³ *Ā'in, op.cit.*, Vol.I, p. 117.

⁹⁴ *Arhsaṭṭa Imārati, op.cit.*, A.D. 1694.

⁹⁵ *Ahwāl, op.cit.*, pp. 47-8. See also R. Nath, for some other such works mentioned earlier.

2 *dāms* per day.⁹⁶ In the Deccan between 1658 to 1663 three scales of wages, that is 20 *dāms*, 8 *dāms* and 7.5 *dāms* daily are mentioned.⁹⁷ The carpenters of Bikaner, between 1670 and 1757 were paid 15 *dāms*, 7.62 *dāms* and 2.6 *dāms* per day.⁹⁸

The lattice and wicker workers (*pinjarasāz*) were paid according to the kind of work undertaken. When they fastened the pieces with string in a dodecagonal, they were paid 24 *dāms* per *gaz*. When they formed a dozen circles, they got 22 *dāms*; for hexagon, 18 *dāms*; for *ja'fari*, 16 *dāms*; and for the chess-board style, 12 *dāms* per *gaz*.⁹⁹ If they joined the sticks by inter-weaving they were paid 48 *dāms* to 40 *dāms* per *gaz*.¹⁰⁰

The wages of the *ārrahkash* depended on the quality of the wood which he was sawing. Thus the sawyer of the *shisham* wood was paid 2½ *dām* per *gaz*, and the one working with *nazhu* wood drew a compensation of 2 *dām* per *gaz* of wood. On the saw he was helped by a labourer who was employed on a daily wage of 2 *dāms* a very low wage-rate at the time.¹⁰¹

The brick-layers were paid 3 ½ *dām* and 3 *dām* for common work. If they were asked to work for the construction of fortress walls with battlements they were paid at the rate of 4 *dāms* per square *gaz* of bricks laid. For all other walls the rate was 2 *dāms*. If the *bēldār* dug foundations he got 2½ *dāms* while those *bēldār s* whose job was to dig ditches were given ½ *dām* per square *gaz*.¹⁰² In 1694 at Amber a *bēldār* was paid 0.35 *dām* for digging a trench – but then we do not know the depth, width or length of the trench.¹⁰³

The well-diggers too were of three kinds with a salary of 2 *dām*, and 1½ *dām* respectively. Well cleaners had their wages which depend on the season. Thus during the winter they got 4 *dāms* per day, while in summers they were paid 3 *dāms* daily. For the job of cleaning a well they were paid Rs.2/-.¹⁰⁴

The brick makers (*khisht-tarāsh*) earned 8 *dāms* for every hundred mounds which they made.¹⁰⁵ Later in 1694 at Amber we find them drawing a daily wage of 11.13 *dāms*.¹⁰⁶ The pounder of bricks (*surkhī-kob*) got 1½ *dām* for pounding a heap of 8 *mans* of old bricks.¹⁰⁷

Amongst the highest paid skilled artisans were the *tabdan tarash* or glass-cutters who earned 100 *dāms* per *gaz* of glass they cut.¹⁰⁸

The *bāns-tarāsh* (bamboo-cutter) worked for a daily wage of 2 *dāms*. The *chappar-band* got 3 *dām* for a day's work, but if he worked on piece-wage, he received 24 *dāms* per 100 square *gaz* of thatching. The reed binder (*patal-hand*) had a wage of 1 *dām* per 4 *gaz*.

⁹⁶ *Ā'in.*, *op.cit.*, Vol.1, p. 117.

⁹⁷ *Mughal Documents, op.cit.*, doc.no.'s. I/383, I/1010, I/1022, III/380 and III/604.

⁹⁸ *Kamthāna Bahi, op.cit.*

⁹⁹ *Ā'in.*, *op.cit.*, vol. I, p. 117.

¹⁰⁰ *Ibid.*

¹⁰¹ *Ibid.*

¹⁰² *Ibid.*

¹⁰³ *Arhsatha Imarati, op.cit.*, 1694

¹⁰⁴ *Ā'in.*, *op.cit.*, vol. I, p. 117.

¹⁰⁵ *Ibid.*

¹⁰⁶ *Arhsatha Imarati, op.cit.*, 1694

¹⁰⁷ *Ā'in.*, *op.cit.*, I, p. 117.

¹⁰⁸ *Ibid.*, I, p. 118.

The varnisher of reeds (*lakhira*) got 2 *dāms* per day under Akbar¹⁰⁹ and 3.48 *dāms* in 1694.¹¹⁰ The *āb-kash* or water carrier worked for 3 *dāms* and 2 *dāms* daily,¹¹¹ whereas in 1694 his salary was to 6.66 *dām* and 4.42 *dām* respectively.¹¹²

A labourer under Akbar, who was supposed to carry a load of stones (*sangbār*) was paid 0.22 *dām* per *man* of load.¹¹³ The same labourer in 1670 was getting 10 *dām* to 7.5 *dām* daily at Bikaner,¹¹⁴ but since the *Ā'in*'s rate was a piece rate, the two rates are not comparable. In the case of other labourers we get a daily wage of 5.8 *dām*, 2.6 *dām* and 2.5 *dām* in 1670. If they were skilled in their job and were brought from some distant place they were comparatively better off with a wage of 20 *dāms* per day.¹¹⁵ As is to be expected the wages of the women labourers were quite low, ranging between 0.12 *dām* and 0.8, *dāms* daily.¹¹⁶ The wages of the labourers working in the *kārkhāna* had a high wage of 10 *dāms* and 7.5 *dāms* daily. The workers at the *hammam* appear to be equally better off with a wage of 7.6 *dāms* per day.¹¹⁷ The *chitr-kār* or painter of houses at Bikaner had a handsome daily income of 11.11 *dāms*.¹¹⁸

A perusal of these wages and salaries points towards a differentiation within the ranks of the various professionals and artisans, which probably arose out of their acquired skill and expertise. It also appears that under Akbar the highest daily wage awarded to an artisan of the building establishment was 7 *dāms* and the lowest 2 *dāms*. The piece-wages on the other hand, varied between 100 *dāms* to ½ *dām* per *gaz*. During Aurangzeb's reign the daily wages varied from 25 *dāms* for imported artisans to 0.8 *dām* for women labourers.

The wages being those of the Imperial Establishment might have differed from those of the private establishments. In one of his *farmans* Aurangzeb mentions the practice of 'forced labour' in Ahmadabad.¹¹⁹ Further Ali Muḥammad Khān writes that once the *gilkārs*, *bēldārs*, *najjārs* and other wage-earners of the buildings of Ahmadabad complained to the Emperor regarding their meagre salary from the state, on which the emperor issued orders to bring about parity in wages between these workers and those 'working at other buildings of the city'.¹²⁰ Thus it appears that the wages current on the private level could be comparatively high.¹²¹

The real import of these wages can be gauged if only we compare them with the prices of the food grains. Thus we see that 4.44 *seers* equal to 6.13 lb. *avdp.* of wheat could be bought for 2 *dāms* under Akbar the average price of barley, gram, *jowār* and *bājra* was 12.64 *dāms*. According to Shireen Moosvi, an unskilled worker in 1595 thus could have

¹⁰⁹ *Ibid*

¹¹⁰ *Arhsaṭṭa Imārati, op.cit.*

¹¹¹ *Ā'in*, I, p. 118.

¹¹² *Arhsaṭṭa Imārati, op.cit.*

¹¹³ *Ā'in*, I, p. 118.

¹¹⁴ *Kamthāna Bahīs, op.cit.*

¹¹⁵ *Ibid*

¹¹⁶ *Ibid*

¹¹⁷ *Ibid.*

¹¹⁸ *Arhsaṭṭa Imārati, op.cit.*

¹¹⁹ Ali, Muhammad Khan, *Mīrāt-i Aḥmadi*, S. Nawab Ali, Calcutta, 1928, Vol. I, p. 260.

¹²⁰ *Ibid.*, Vol. I, p. 276.

¹²¹ See also Moreland, 'The Prices and Wages under Akbar', *JRAS*, 1917, pp. 815-25.

food in much greater quantity than in the latter half of the nineteenth century. She says that a wage-earner of 2 *dāms* per day could save 10 per cent of his annual income.¹²²

In 1694 at Amber one rupee could buy one *man* of wheat or *moth* or $1\frac{1}{4}$ *man* of grain or barley. For $1\frac{1}{2}$ rupees one *man* of *Bājra* or *Jowār* could be bought; whereas *urad* (pulse) was priced at Rs.2.25 per *man*.¹²³

Thus it appears that the seemingly low wages of the artisans were high enough to fill the stomach and cater to their basic needs.

The depiction in the Mughal miniatures also establishes the respective positions of the people involved in the constructional activities. A total of nineteen categories of craftsmen have been mentioned by Abu'l Fazl. Each of these categories is further sub-divided into a number of sub-categories, depending on the job and expertise. Some light on the personnel involved in the constructional activity at Fathpur Sīkri buildings is also thrown through 'minor inscriptions' in the form of names dates and symbols left behind on individual pieces of stones. From these we come to know not only some actual names of the builders but also some information as to whom they were.¹²⁴

For the construction of the common man's house, on the other hand, the services of all these skilled artisans appear to have been unnecessary. A mason and a few labourers would have sufficed for their constructional need.

The profession of construction was not confined to any one religion, though as can well be assumed, the artisans were mostly Hindus. Banarsi Das, writing during Jahangir's reign opines that masons, carpenters etc. were to be classed as Shudras.¹²⁵

The information on building workers is yet too incomplete to sustain any elegant analysis. Yet a dimly outlined picture emerges of rigorous specialisation among the workers and, above them, a class of *mi'mārs* who appear to have been architects, supervisors and even masons, all rolled into one.

Techniques, Inspirations and Influences:

From the analysis of the actual builders given above, it becomes clear that the architects and engineers, who planned and designed the buildings were generally Central Asians, Iranians or Timurids, whereas the "master-craftsmen" like the masons, bricklayers, carpenters and others, if not all non-Muslims, were generally Indians. This was bound to have impact on the architecture that they jointly created.

New techniques of building construction and new building materials were introduced by the time that Mughal Empire came to be established.¹²⁶ The constructional principle applied

¹²² Shireen Moosvi, *The Economy of the Mughal Empire c. 1595: A Statistical Survey*, Delhi, 1987, pp. 336, 344.

¹²³ S.P. Gupta, op.cit., pp. 76-82.

¹²⁴ See for details Syed Ali Nadeem Rezavi, "Marks and Symbols of Professionals on Mughal Monuments", in Himanshu Prabha Ray (ed.), *Sacred Landscapes in Asia Shared Traditions Multiple Histories*, IIC New Delhi (Manohar), 2007, pp. 107-67; See also Ebba Koch, *The Complete Taj Mahal: And the Riverfront Gardens of Agra*, Thames & Hudson, London, 2006 (reprint, Bookwise, New Delhi, 2006-7), pp. 83-101; R. Balasubramaniam, "New Insights on Artisans on Taj", *Indian Journal of History of Science*, INSA, New Delhi, vol. 44, no. 4, December 2009, pp. 521-50

¹²⁵ Banarsi Das, *Ardhakathanaka*, ed. Makund Lath, Jaipur, 1981, p.226.

in India before the Ghurian conquest of the late twelfth and thirteenth centuries was *trabeate*, in which all spaces were spanned by means of beams laid horizontally. Through this technique, the resultant structures would be flat-roofed and low. No building or open-halled structure could be constructed without raising the roofs to excessive heights through stepped inclining walls (as in *śikhara*).¹²⁷ Heaviness, not lack of durability, was the consequence of trabeate architecture. Built of heavy building material, generally stone, they would also not be in need of mortar or cementing material: the law of gravitational pull would help in holding them together.

This had, during the Sultanate period been replaced by the arcuate technique with its consequent use of bricks and lime mortar. The use of these new building materials: the lime-mortar, gypsum, *surkhī* and the brick which they helped to bind, led to cheaper costs of construction. There was a proliferation in the building constructional activity. With cheaper costs, men of lesser means could also indulge in the luxury of building activity. Thus if previously only public structures and places of worship were generally constructed, now a large variety of buildings, both religious (mosques, temples, tombs, *Khānqahs*) and secular (palaces, *sarāīs*, bazars and residential structures, works of hydraulics etc) sponsored both by king and laity resulted.

Some other aspects of Mughal Architecture worth our consideration include the digging of foundations and the techniques of lifting stones and other heavy material and their transportation from one place to another.

From Shāhjahān's reign we have some information as to how the foundations were laid to give a firm base to the superstructures, especially on river-fronts. At the time of laying the foundation, the chief architects, the *muhandis* and/or the *mi'mār* first chalked out the plan on the ground and then the diggers (*bēldār*) excavated the foundations to considerable depths.¹²⁸ The foundations of the Tāj Maḥal were "built of stone (*sang*) and [watertight] mortar (*saruf*)."¹²⁹ Abū Ṭālib Kalīm gives us the details of how the foundation near the river bank was laid out:

Since there is sand where there is a river, it is difficult to lay down foundations: As sand is removed, it fills in again.

They dig a well (*chāh*) to manage the work and firmly set in wood, all the while taking out sand from inside until they reach the solid ground below.

This well they fill up with stones and iron up to the surface.

¹²⁶ For details see S. Ali Nadeem Rezavi, "Medieval Indian Architecture: Its History and Evolution", *Symposium: History of Visual Arts-Architecture, Sculpture and Pā'ntings*, *Symposia Paper 29*, Indian History Congress 73rd Session, Mumbai, 29 December 2012

¹²⁷ This technique of upright posts supporting the horizontal lintels or beams was basically derived from timber constructions. To make the construction more firm, brackets were employed. See Charles Fabri, *An Introduction to Indian Architecture*, Bombay, 1963, p.13

¹²⁸ Muhammad Salih Kanboh, *Amal-i Sālih*, Ghulam Yazdani, Bib.Ind., Calcutta, 1912-46, vol. III, p. 21, Abdul Hamid Lahori, *Padshahnama*, ed. Kabiruddin Ahmad, Abdur Rahim & W.N. Lees, Bib. Ind., Calcutta, 1867-68, vol. I, p. 223

¹²⁹ Lahori, op.cit., I, p. 223

Another well is similarly sunk nearby in the same fashion so that the building may be erected on them, which rises like a mountain.¹³⁰

From this it is clear that the foundations were secured through double-well constructions, each cased with wood and filled with rubble and iron and bound with a leak-proof mortar. Such wells filled with rubble were not only encountered during the excavations of the Archaeological Survey of India on the foundations of the Tāj Mahal¹³¹, but have also been encountered during subsequent surveys and explorations at a number of places along the river at Agra.¹³²

As far as the lifting of heavy building material and transporting large blocks of stone is concerned, it appears that the Mughal architects resorted to certain techniques which probably had been in existence at least from the late fourteenth century.

A perusal of the Mughal miniatures depicting constructional activity fails to provide any evidence of the use of wheel barrows or pulleys, which latter however are witnessed in Persian miniatures. The simplest way of lifting weights was through wicker-baskets carried on labourer's heads climbing the wooden ramps.¹³³ But there is no depiction of the capstan nor that of a pulley in the Mughal miniatures. However we do hear of a device, *jarr-i saqīl*, which was used for dragging, hoisting or hauling heavy objects.¹³⁴ Was this just a general term for a device or was it a technique for lifting heavy objects? Or was it indeed the 'capstan' which was being referred thus? When Jahangir ordered the re-erection of an Aśokan Pillar at Allāhabād Fort, and had his inscription put over it, his engineers would have certainly used a device other than a ramp to erect a 40 to 50 ton heavy and 10.7 m long pillar.

We have some evidence regarding this from a manuscript of an anonymous text, *Sīrat-i Fīrūzshāhi* copied and illustrated in 1002 AH / 1593-94 AD during the reign of Akbar.¹³⁵ The series of illustrations in this manuscript not only explain the text, but show capstans being used to lift and transport the heavy stone pillars.¹³⁶ The text applies the term *charkh* for these capstans. Their use and depiction in this illustrated text is not surprising as we know that capstans had been used in the operation of military devices known as *manjanīq* (mangonel or trebuchet). These machines were first used by the Chinese in 5th-6th Century. The first image of such a machine originates from a wall painting in the Pendzhikent palace in Central Asia in Samarqand, and dates back to the end of the 7th or the beginning of the 8th century. It depicts a human-operated machine employing a sling.¹³⁷ The most important surviving technical treatise on these machines is *Kitāb anīq fī al-Manajanīq*

¹³⁰ Abu Talib Kalim, *Pādshāhnāma*, Ms. Ethe, BL 1570, f. 116a

¹³¹ *Indian Archaeological Review* (1957-58), p. 83 & *Indian Archaeological Review* (1958-59), p. 95

¹³² Ebba Koch, *The Complete Taj Mahal*, op.cit., pp. 22-81

¹³³ See for example, 'The Construction of Agra Fort', *Akbarnama*, V & A Museum, London, no. IS-2-1896, f. 46/117; 'Construction of Fathpur Sikri', *Akbarnama*, V & A Museum, London, no. IS-2-1896, f. 91/117

¹³⁴ Abul Fazl, *Akbarnama*, vol. II, Bib Ind, Calcutta, 1873, p. 337; *Amal-i Salih*, op.cit., III, p. 38

¹³⁵ *Sīrat-i Fīrūzshāhi*, Ms. Khuda Bakhsh Oriental Library, Patna, facsimile edition, 1999, ff. 91(b) – 105(b)

¹³⁶ For a detailed discussion on this issue, see S. Ali Nadeem Rezavi, "Medieval India: The Relocation of Ashokan Pillars by Firuzshah Tughluq", *Proceeding of the Indian History Congress*, 70th Session, Delhi, 2009-10, Kolkata, 2010, pp. 994-1010

¹³⁷ H. Nickel, *The Mutual Influence of Europe and Asia in the Field of Arms and Armour – Companion to Medieval Arms and Armour*, ed. D. Nicole. The Boydell Press, Rochester, 2002, p. 124; See also Paul E. Chevedden, "Artillery in Late Antiquity: Prelude to the Middle Ages", in *The Medieval City under Siege*, ed., Ivy A. Corfis and Michael Wolfe, Boydell Press, Suffolk, 1995

(An Elegant Book on Trebuchets), written in 1462 AD by Yūsuf ibn Urunbugha al-Zaradkash. One of the most profusely illustrated Arabic manuscripts ever produced, it provides detailed construction and operating information. These writings are particularly significant because they offer a unique insight into the applied mechanics of pre-modern societies.¹³⁸ This mechanical device consisted of a wooden beam pivoted on a wooden stand. The short arm of the beam has a counterweight put on it, while the long arm had a sling suspended at its far end which carried the missile or projectile which was usually in the form of a large piece of stone. In the hands of the Mongols a winch or a capstan had been added to it which made it possible for lesser number of men to pull down the long arm. Probably this was the type of the machine which was used in the battle of Sind during the thirteenth century.¹³⁹ A drawing by Thomas Bowrey and a description of a hauling of ship during repairs in 1679 at Narsapur in Coastal Andhra also brings to light the use of 'crab', which was a form of capstan and tackles which are used to concentrate hauling power by slowing down the movement.¹⁴⁰ This device has also not been mentioned by any of the contemporary indigenous sources.

The series of illustrations of *Sīrat-i Fīruzshāhi* also depict boats and carts which were used to carry heavy loads from one place to another. Manrique, who witnessed the construction of the building of the Tāj Mahal in 1640-41 too mentions the use of the bullock cart to transport the building blocks:

Some of these blocks, which I met on the way...were of such unusual size and length that they drew the sweat of many powerful teams of oxen and of fierce-looking, big-horned buffaloes, which were dragging enormous, strongly made wagons, in teams of twenty or thirty animals.¹⁴¹

From the *Akbarnāma* paintings we come to know that once these heavy slabs arrived on the construction site, they were sectioned with the help of iron wedges and sledgehammers.¹⁴² The double-page illustration of the Construction of the Agra Fort depicts not only a bullock-cart bringing a heavy slab, but also the process of cleaving and splitting of the stone slabs with the use of hammers and iron wedges, as well as the wooden ramp on which labourers are shown carrying heavy blocks with the help of rope slings tied to bamboo poles. They support themselves using a walking stick.

It was not that the local artisans, engineers and architects were only learning from the newcomers. A number of scholars like E.B. Havell have emphasized the indigenous influences and sources for the emerging architecture. To Havell, the *mīhrāb* was a Buddhist loan of the niche to Islam. Even the term *butkhāna* used by the Arabs for the temples was a corruption of '*Bud-khāna*' or Buddha-house.¹⁴³ In fact he went on to argue that the

¹³⁸ Paul E. Chevedden, Les Eigenbrod, Vernard Foley and Werner Soedel, "The Tribuchet", *Scientific American, Special Issue The Science of War: Weapons*, February, 2002, online issue no. 3

¹³⁹ Ali Kufi, *Chachnāma*, tr. Mirza Kalich Beg, Commissioner's Press, Karachi, 1900. See Irfan Habib, *Technology in Medieval India c. 650-1750*, Being no. 20 of *The Peoples History of India Series*, New Delhi, 2008, p. 88

¹⁴⁰ Thomas Bowrey, *A Geographical Account of Countries Round the Bay of Bengal, 1669 to 1679*, ed. RC Temple, Cambridge, 1905. Cf. Irfan Habib, *Technology in Medieval India*, op.cit., pp. 58, 114-15

¹⁴¹ Sebastien Manrique, *Travels of Fray Sebastien Manrique, 1629-1643*, transl., C.E.Luard & H.Hosten, vol. II, Hakluyt Society, London, 1927, p. 172

¹⁴² See 'The Construction of Agra Fort', *Akbarnama*, V & A Museum, London, no. IS-2-1896, ff. 45- 46/117

¹⁴³ EB Havell, *Indian Architecture: Its Psychology, Structure, and History from the First Muhammadan Invasion to the Present Day*, London, 1913, pp.5-6

'Saracenic' art which came to India had been Indianized before it crossed the Indus.¹⁴⁴ Thus the bulbous dome, as at the Tāj Mahal, was a derivation from the Buddhist Stupa tradition.¹⁴⁵

The recent scholarship on Mughal Architecture can be broadly divided into two ideological groups: One, which like Havell emphasise the indigenous influences and sources, and the other, to whom the Medieval Indian architecture was basically derived from Persian and Central Asian traditions.

The first group may be represented by the voluminous contributions of R. Nath and R. Balasubramaniam amongst others. According to the former, the source of architectural design and elements was the ancient Indian knowledge as ingrained in the *śilpasastras* and other traditional texts.¹⁴⁶ To Balasubramaniam, a dimensional analysis of Mughal monuments, like the Tāj Mahal reveal a modular planning executed using traditional measurement units mentioned in the *Arthaśāstras*.¹⁴⁷ This may be so, as the actual builders of these monuments, the master-masons and stone-cutters were generally indigenous craftsmen.¹⁴⁸ To Balasubramaniam an analysis of the measurements at the Mughal monuments like the Tāj Mahal point to the fact that the team of architects were well versed in the civil engineering tradition of the subcontinent. The measurements at the Tāj accord with the measures listed by Kautilya, with *aṅgula* considered constant at 1.763 cm.¹⁴⁹

Ebba Koch, Catherine Asher and a number of others have laid emphasis on the foreign sources as inspirations for the Medieval Indian Architecture. To Ebba Koch, while the Mughal Architecture was a supremely confident style created through a synthesis of heterogeneous elements (viz. Trans Oxanian, Timurid, Indian, Persian and European), its sustaining element, especially during its initial phase, was Timurid.¹⁵⁰ She went on to make a study of the symbolic forms and motifs.

Indo-Muslim architecture, as it developed in medieval India, heavily borrowed stylistic, idiomatic (characteristic forms, architectonic and decorative), axiomorphic (forms appropriate to the purpose of the structure) and aesthetic traditions from Iranian, Trans-Oxanian and regional Indian styles. This borrowing was much heavier after the establishment of the Mughal dynasty. Mughal architecture borrowed extensively from the Delhi Sultanate, Sharqi, Gujarat, Malwa, Bengal and Rajasthani styles, as well as from styles

¹⁴⁴ Ibid., p. 11

¹⁴⁵ Ibid., pp. 23-24

¹⁴⁶ See for example R. Nath, *Colour Decoration in Mughal Architecture*, Bombay, 1970; idem, *History of Decorative Art in Mughal Architecture*, 1976; idem, *Some Aspects of Mughal Architecture*, New Delhi, 1976; idem, *History of Mughal Architecture* (2 vols.), New Delhi, 1982-85

¹⁴⁷ R. Balasubramaniam, "New Insights on Metrology during the Mughal Period", *Indian Journal of History of Science*, 2008, no. 48, pp. 569-88; idem, "New Insights on the Modular Planning of the Taj Mahal", *Current Science*, 2009, vol. 97, no. 1, pp. 42-49

¹⁴⁸ See S. Ali Nadeem Rezavi, "Marks and Symbols of Professionals on Mughal Monuments", in Himanshu Prabha Ray (ed.), *Sacred Landscapes in Asia: Shared Traditions, Multiple Histories*, New Delhi, 2007, pp. 107-67; See also S. Ali Nadeem Rezavi, *Fathpur Sikri Revisited*, OUP, New Delhi, 2013, pp. 176-202

¹⁴⁹ R. Balasubramaniam, "New Insights on Metrology during the Mughal Period", *Indian Journal of History of Science*, 2008, no. 48, pp. 569-88

¹⁵⁰ Ebba Koch, *Ebba Koch, Mughal Architecture: An Outline of its History and Development (1526-1858)*, Prestel-Verlag, Munich, 1991 (reprint Delhi, 2014), p.14

abroad, so much so that it has itself been defined as a synthesis of these foreign and indigenous styles.¹⁵¹

Styles, Plans and Designs:

The establishment of the Mughal rule in India marks a definitive phase of the Medieval Indian Architecture. Although technically the foundation of the 'Mughal School' of architecture was laid during the reign of Akbar, the beginnings of new features which were to have a far reaching effect, were made from the period of Babur himself. When Babur marched into India, he brought along with him two Iranian architects, Ustād Mīr Mīrak Ghiyās of Herāt and Ustād Shāh Muḥammad of Khurāsān.¹⁵² It was under their watchful supervision that the first Mughal architectural projects were completed. From an extant mosque which can be directly attributed to Babur it appears that the process of assimilation started with these initial projects itself. Thus at the Kābuli Bāgh mosque of Pānīpat one find typical Tughluq-Lodi style surface carvings along with the use of rubble-stone with a heavy veneer of plaster and an ashlayer of red sandstone on the portals, side by side with the typical Central Asian tradition of multiple domes and arch-netted pendentives in pseudo structural plaster relief-work.¹⁵³ These domes, unlike any other domes built in India, are not surmounted with a *kalaśa* pinnacle but are provided with a Central Asian *raushandān*.

The second innovation of the period was the introduction of the four-quartered garden: the *chahār-bāgh*. Idiomatically and axiomorphically, these four-quartered paradisaical gardens with their intersecting water-channels lined with walk-ways (*khīyābāns*), platforms, water-chutes, tanks and fountains, flower-beds, fruit bearing trees and foliages, all surrounded by screen walls and gateways were to become the standard setting for Mughal tombs.¹⁵⁴ In these gardens, the focus was the centre, marked by the construction of a large platform. In its funerary variant this central platform was replaced by the mausoleum. Typical examples of such funerary gardens from the Mughal period are Humāyūn's Tomb at Delhi, the Tombs of Akbar and Mariam at Sikandara (Agra), the Tomb of I'timādud Daulah at Agra and the Tomb of Jahāngīr at Shāhdara, Lahore. In the Tāj, the focus was shifted from the centre to the periphery, namely the river front, where the mausoleum was now constructed. Further enhancement to the river-front was provided by constructing octagonal bastions flanked by a mosque (west) and a *mehmānkhāna* (east) at opposite corners. The mausoleum and the main gateway are on the main axis, while the terminals of the transverse axes are marked by a pavilion on each side. The structures on the terminal points of the axes of the garden result in a cruciform shape which is similar to the plan of cruciform (*chahārtāq*) tombs and mosques of Iran, such as the *Muṣalla* of Gauhar Shad, Herat (1417-38), and Jāmi' Masjid Turbat-i Shāikh Jām (1440-43). This shift of emphasis from the centre to the terminus is, however, first seen in the Tomb of I'timād-ud Daulah, where although the mausoleum was retained in the centre, a

¹⁵¹ See, for example, Ebba Koch, *Mughal Architecture: An Outline of its History and Development (1526-1858)*, Prestel-Verlag, Munich, 1991(reprint, Delhi, 2014); and Catherine B. Asher, *Architecture of Mughal India*, being Vol. I, pt. 4 of 'The New Cambridge History of India', Oxford University Press, 1995. See also Lisa Golombek, 'From Tamerlane to the Taj Mahal', in *Essays in Islamic Art and Architecture in Honor of Katherina Otto-Dorn*, (ed.) Abbas Daneshwari, Malibu, 1981 (reprinted in Monica Juneja, *Architecture in Medieval India*, New Delhi, 2001, pp. 315-27).

¹⁵² *Bāburnāma*, (tr.) A.S. Beveridge, New Delhi, 1970, pp.343, 642.

¹⁵³ Catherine Asher, Catherine B. Asher, *Architecture of Mughal India*, op.cit., pp. 25-26; Ebba Koch, *Ebba Koch, Mughal Architecture*, op.cit., p. 32

¹⁵⁴ For a study and survey of some Mughal gardens, see S. Ali Nadeem Rezavi, *Fathpur Sikri Revisited*, op.cit., pp. 126-33

river-side decorated pavilion was added.¹⁵⁵ A fore-court (*jilau khāna*) with a series of cloistered cells is also added to the *chahārbāghs* in the tomb of Jahangir and in the Tāj Mahal.

Many innovations and new features were added to the field during the reign of Akbar. The fore-most of these was the concept of monumentality. Never before in India had such monumental structures been built. The tomb of Humayun at Delhi built by Mīrak Ghiyās and the Buland Darwāza of Fathpur Sīkri, and the tomb of Akbar himself were all conceived on a very grand scale. This tradition seems to have continued till the last.

A number of new building plans and architectural features were introduced from this onwards. For example the Noni partite Plan, popularly known as the *hasht bihisht* plan in the Iranian tradition was introduced on a large scale during this reign. In this plan the layout, which is preferably an irregular octagon (a chamfered square — *musamman-i baghdādī*), is divided by four intersecting constructional lines into nine parts, comprising a domed octagonal chamber in the centre, rectangular open halls (in the form of either *pīshṭāq* or flat roofed *aiwāns* supported by pillars) and double storeyed octagonal vaulted chambers in the corners. This plan provided the buildings a radial symmetry which hitherto was missing. The radial symmetry was further emphasised by the axial and radial passages which linked the nine chambers with each other.

The most famous Mughal monumental funerary structures constructed on this Timurid plan is Humayun's Tomb at Delhi. This plan was later perfected during the reign of Shāhjahān to give shape to the Tāj Mahal at Agra. Another example of a noni partite tomb is the Tomb of Anārkalī at Lahore, which again, is one of the most ingeniously planned Mughal structures.

The noni-partite plan was also applied by the Mughals to tombs which were regular octagons. The Tomb of Shāh Qulī Khān at Narnaul, Tomb of Hājī Muḥammad at Sirhind and Tomb of Quṭbuddin Muḥammad Khān at Vadodara are some of the funerary structures of Akbar's reign which were regular octagons with noni partite plans.

This plan was applied to palace buildings like Akbar's pavilion at the Ajmer Fort and the Buland Darwāza at Fathpur Sīkri, and Rāni ka Mahal at Allāhabād Fort. Pleasure pavilions and water palaces like Hāda Mahal at Fathpur Sīkri, Shāh Qūlī's Water palace at Nārnaul and I'timād Khān's Water palace (popularly known as Burhia ka Tāl) at Etmādpur (Agra) were also constructed on this pattern.

The noni-partite plan was also applied to square structures. Akbar's Ajmer pavilion and Shāh Qūlī's water palace were square-structures. The best example of this type is, however, the Tomb of Itimādud Daulah at Agra. These square noni-partite structures were probably constructed in the style of such as Khānqāh of Qāsim Shaikh at Kermin, Bukhārā and the Tomb of Ulugh Beg and 'Abdur Razzāq in the vicinity of Ghazni. This plan was applied to a large number of Mughal *hammāms*, for example the *hammām* of Abdur Rahīm Khān-i Khānān at Burhānpur and the Imperial *hammāms* at Fathpur Sīkri.

Another innovative introduction was of the Khurāsānian vault which was needed for massive buildings built on noni partite plans. This type of vault consists of four large intersecting ribs, which create a central vaulted area, four lozenge-shaped squinches and four

¹⁵⁵ For further such examples from the reigns of Jahangir and Shahjahan one might refer to the Buland Bāgh, Bāgh-i Nūr Afshān and Bāgh-i Jahānārā, all situated on the left bank of Yamuna at Agra. For the Bāgh-i Jahānārā (Zahra Bāgh) see Ebba Koch, "The Zahara Bāgh (Bāgh-i Jahānārā) at Agra", *Environmental Design*, op.cit., n.d., pp.30-37. (special issue on 'The City as a Garden')

rectangular fields. In this plan the centre of each side of the square contains an arched recess, the width of which is equivalent to the diameter of the dome, which is supported by the four arches which in turn spring from the forward edge of the recess arches, each adjacent pair intersecting to form the square. The secondary ribs springing from the haunches of the arches converts the square into an octagon by a series of lozenge shaped squinches. At the second stage of the phase of transition, sixteen fan-shaped pendentives complete the transition to the circular dome. With this system the vaulting techniques reach perfection. The need of supporting walls is eliminated and the dome now sits directly on the four arches. This type of vault consists of four large intersecting ribs, which create a central vaulted area, four lozenge-shaped squinches and four rectangular fields. In this plan the centre of each side of the square contains an arched recess, the width of which is equivalent to the diameter of the dome, which is supported by the four arches which in turn spring from the forward edge of the recess arches, each adjacent pair intersecting to form the square. The secondary ribs springing from the haunches of the arches converts the square into an octagon by a series of lozenge shaped squinches. At the second stage of the phase of transition, sixteen fan-shaped pendentives complete the transition to the circular dome.

In the Mughal Empire, we find its occurrence in the Imperial *hammām* (the so-called Hakīm's Baths), the Private *hammām* in the *daulatkhāna*, the *hammām* attached to the *Haramsarā* ('Jodhbai Palace'), all at Fathpur Sīkri, as well as at Akbar's *Khilwatgāh* in Allahabad Fort, the Barber's tomb in the garden of Humāyūn's Tomb and the Govind Dev Temple at Vrindavan, near Mathura (1590's).

Akbar's period was also a period when a large borrowing of 'Indian' traditions in the field of art, literature, painting, music and architecture takes place. The 'Indian' features were seamlessly diffused in the newly emerging Iranian and Timurid idiomatics, axiomorphics and aesthetics. As under the Tughluqs, albeit on a much grander scale, there was an attempt to mix the trabeate with the arcuate. Both the traditions were employed by the Akbar's architects in the same structure. From the 'Akbari Mahal' and 'Jahāngīrī Maḥal' at Agra Fort to almost all the structures at Fathpur Sīkri to the Vrindavan temples, this blending of the two very diverse techniques is encountered. So much so that even when a building is domed or vaulted, the dome or the vault is deliberately hidden below a flat platform giving the structure a classic trabeate shape. The trabeate style is further accentuated by providing heavy brackets to the drooping eaves. It seems that the Akbar's architects were trying to hide the arcuate elements of the structures.

But then, was this combination of various foreign and indigenous architectural elements, an extension of the policy of '*Sulh-i Kul*'? In other words, was this intermingling of Timurid and Central Asian with indigenous, a conscious mixing of 'Muslim' and 'Hindu' architecture? Most likely not. Unlike modern scholarship, Akbar was most likely not aware of the 'religion' of the architectural elements used in his constructional projects. He would have been unable to comprehend that a flat roof or a 'chain and bell' motif was 'Hindu', while an arch and a dome were 'Islamic'. Most of the architectural elements which modern scholars consider as 'Hindu' and derived from temples, had already been 'Islamicised' by being incorporated into Muslim religious structures built during the pre-Mughal times.

Secondly the Akbar's architect dispersed these visually hidden vaulted and domed chambers around vast open spaces which were linked to each other through elaborate post-and-beam colonnades. Some of these colonnaded structures were super-imposed to form two or more stories. Thirdly his architectural plans were marked by grand voids interspersed with

vertical masses which are totally immersed within these open spaces. These are realised and created through enclosing a space with articulated walls or single-bay arcades or corridors and then placing a free-standing structure within this space. Such a scheme is typical of a mobile camp or a tented city of yore.

During the Mughal period the mosque plan also assimilated some of the symbolism as well as the idiomatic and structural features of the Hindu temples, producing mosque structures which have no parallel elsewhere in the Islamic world. One of the features which give a templar character to these Indian mosques is the triplication of the sanctuary, a feature which is so characteristic of the Late Chalukyan, Kakatiyan and the Hoysala temples. The triplication of the mosque sanctuary, the western liwan, is indicated by its being crowned with a triad of domes, which is first encountered at some Sultanate period mosques and then monumentalised at the Jāmi' Mosques of Sikri, Āgra, Shāhjahānabād and Lahore built respectively under Akbar, Shāhjahān and Aurangzeb. It is essential to note here that such triple domed mosques are absent elsewhere in the Muslim world.

Secondly we find the raising of the mosque on a high plinth or platform, which again is not encountered elsewhere outside the Indian sub-continent. This process appears to have started under the Tughluqs, re-established at Fathpur and culminated at Shāhjahānabād (Delhi) and Lahore.

Thirdly greater sacrality is given to the western liwan through a gradual hierarchy starting from the portals. The Iranian 2-*aiwān* and 4-*aiwān* mosques had a cloister of arcades in two storeys, marked by the portals at its cardinal points. The height of the arcades was the same along the four sides. From the time of Akbar, the Iranian type of mosques are tempered by the Indian sense of the hierarchy: instead of two storied cloisters on the east, north and south of the courtyard of the mosque, one now encounters lower single storied *rivāqs*. The gradual hierarchy is also maintained by enlarging the central dome which surmounts the nave of the main prayer chamber. The Jāmi' Mosque of Fathpur Sikri, Shāhjahānabād and Lahore are typical examples of this templar mosque in India. This perhaps more than anything else reflects the eclectic nature of the period.

This process, however, was a two way process: if the temple architecture had its influence on the mosque construction, the Akbari temples were not left far behind in this process of shared heritage and feature exchange. The Govind Dev Temple at Vrindavan, Mathura has a typical cruciform plan covered with a well-developed Timurid *chahārtāq* Khurasanian vault. This temple along with Madan Mohan Temple and Jagat Kishore temple resemble the elevations and surface decorations of Akbari red sand stone structures at Fathpur Sikri and elsewhere.¹⁵⁶

The period of Jahangir, although relegated both by traditional and modern historians as a period of 'transition', was in fact a period of 'innovation and transformation'. The use of white marble as a medium of construction and the peitra dura as a mode of surface ornamentations can be dated to this period. The Tomb of Salim Chishti at Fathpur Sikri (completed under Jahangir), the tomb of Itimādud Daulah at Āgra and the tomb of Jahangir himself at Shāhdara all are adorned with either or both of these two innovative introductions.

¹⁵⁶ See Margaret H. Case (ed.), *Govindadeva A Dialogue in Stone*, IGNCA, New Delhi, 1996, pp. 11-69

Similarly the drawing of Christian themes and idealized birds on the walls was also a Jahāngīrī innovation. Typical examples of such wall paintings survive at the Fort of Lahore as well as the Bāgh-i Nūr Afshān at Agra.¹⁵⁷

Shāhjahān's period has been stressed as the 'period of zenith' of Mughal Architecture and the Persian and Central Asian influence have been greatly emphasized. To me it however appears to have been a period surcharged with indigenous influences: the multi-foliated arch, the baluster column, the floral motif on the base of the pillars and the lotus bud adorning the tip of the Shāhjahānī arch were all local loans, some from Jain, others from Hindu or Jain traditions.

An innovative tradition which has somehow been generally missed is the fact that it was from the period of Shāhjahān that minarets became a part of the mosque structure. Though at the Qubbatul Islam, there is the Qutb Minar, it is constructed as a separate tower independent of the building of the mosque. Throughout the Delhi Sultanate and the Mughal Empire no mosque had a *mināra*. The first appearance of the minaret as part of the mosque building starts with the Mosque of Jahānārā (Jāmi' Masjid) at Agra. Here the minarets are in a stunted form. It is from the Jāmi' Masjid of Shāhjahānābād that slender pillars start flourishing. They are retained in the Wazīr Khān Mosque at Lahore and then at the Jāmi' Masjid of Lahore built during the reign of Aurangzeb.

If Akbar had his Abu'l Faḥl to proclaim his greatness, Shāhjahān had his Tāj to trumpet his eminence. Unfortunately Aurangzeb was bereft of both: and thus his reign is taken to signify the period of decline, not only in the field of politics but also of art and architecture.

It is a general belief that as he was a staunch Sunni, he commissioned only religious buildings like mosques and is held responsible for the destruction of many of the temples. A look at modern works and explorations however reveal that Aurangzeb also commissioned structures like *sarais*, baths, gardens, tombs and fortified walls. Is this not true for other reigns as well? He is also credited to have repaired mosques built during earlier reigns and built many within captured forts.

The best known mosques of Aurangzeb's period include the Moti Masjid in the Delhi Fort, a mosque on the site of the Keshav Dev Temple at Mathura (destroyed 1669-70) and the Badshahi Mosque of Lahore.

The first and the last are very ornate structures: the Moti Masjid is a marble structure, while the Lahore mosque is a red sand stone structure with insertions of white marble. The Mathura Mosque is more austere and resembles the mosques built by royal ladies of Shāhjahān's reign.

Some of the architectural features which distinguish the mosques constructed during the reign of Aurangzeb are as follows:

1. Most of these mosques stress their vertical elevation: they are all provided with minarets which provide them with the vertical perspective. This is true not only for the

¹⁵⁷ Ebba Koch, *Ebba Koch, Mughal Architecture*, op.cit., pp.70-93; idem, "Jahangir and the Angels: Recently Discovered Wall Pā'intings under European Influence in the Fort of Lahore", in J. Deppert (ed.), *India and the West*, New Delhi, 1983, pp. 173-95; idem, "Notes on the Pā'inted and Sculptured Decoration of Nur Jahan's Pavilions in the Ram Bāgh (Bāgh-i Nur Afshan) at Agra", R. Skelton, et. al., (ed), *Facets of Indian Art: A Symposium held at Victoria and Albert Museum*, London, 1986, pp. 51-65

above mentioned mosques, but also for the Jāmi' Masjids at Mathura, Merta and Varanasi.

2. As pointed out by Ebba Koch, the ornamentation is richly organic, which not only reflects Aurangzeb's lack of personal interest, but also displays forms once appropriate for the palace architecture, such as the ornament on Shāhjahān's Delhi throne, were now utilized on palace mosques.

As far as the Tomb architecture under Aurangzeb is concerned, it is best represented by the Tomb of Rābi'a Daurāni (who died in 1657) built at Aurangabad in 1660-61. Although a rough copy of the Tāj, it reflects a new aesthetic that developed in Aurangzeb's reign. Just as in the case of mosques, instead of perfect balance of proportions which were a hall-mark of Shāhjahān's reign, *there is an emphasis on verticality*. Further, though generally treated as evidence of 'decline', this tomb reveals a new spatial arrangement, as well as a *highly naturalistic fine floral ornament, much of it in stucco*, which according to Asher, makes it appear quite innovative.

With this tomb also truly ends the long established imperial tradition of setting monumental mausolea within a *chahār-bāgh*: Now we find burials within courtyards of mosques or shrines with just a screen and a cenotaph such as the grave of Jahānārā, the tomb of Aurangzeb at Khuldābād. Was this just a full circle: from an open to sky tomb of Babur at Kābul to Aurangzeb's tomb at Khuldābād? Probably where the resemblance ends is that the former is located within a garden, the latter within a Chishti shrine.